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Act of 1903 provides that no children may engage in street-trading under the age of eleven, and limits the hours of boys under fourteen and girls under sixteen to the period between 6 a. m. and 9 p. m. The local authorities cannot extend these limits, but they are empowered to make by-laws greatly restricting them and extending the age below which street-trading is forbidden. They may also allow or prohibit street-trading on Sundays.

Mr. Keeling gives sets of specimen by-laws typical of the regulations adopted by the municipal authorities. Even the most stringent leave room for a vast amount of child labor which would be considered excessive by most American authorities on the subject. Mr. Keeling estimates that there are in the United Kingdom 577,321 boys and girls under fourteen who are working for wages, including 34,535 half-timers who are working in the cotton factories. Roughly speaking, two-thirds of these children are boys and one-third girls; but it must be remembered that the author's tables take no account of the work done by girls in their own homes. Mr. Keeling states that this estimate of the number of working children is conservative, as it is impossible to get the figures for the many town and county areas in which there are no by-laws regulating the general employment of children. At any rate the figures are large enough to show the need of a more uniform enforcement of protective laws which are far from being radical in their provisions even when utilized to the fullest degree by the most advanced local-governing bodies.

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Graphic Methods for Presenting Facts. By WILLARD C. BRINTON. New York, The Engineering Magazine Company, 1914. —xii, 371 pp.

After statistical data have been collected in a first-hand investigation there are three courses open for their presentation. They may be filed away on cards or schedules for reference as are death certificates in the health department, or pay-rolls in a business office, in which case only those vitally interested in some fact recorded ever consult them. They may be analyzed in more or less detail, presenting tables of deaths according to nationality, occupation, age, sex and cause, showing the number of deaths which occur from a specified number of persons in each of these groups. The business manager may calculate average wages and compare with the cost of raw material or capital equipment, or he may compare the wages paid with the efficiency of the workman.

When facts are thus summarized, analyzed and compared, more persons are interested and able to grasp their meaning, and to utilize the knowledge gained.

Nevertheless, there are strict limitations upon the utility of tables of figures, even when reduced to the briefest and clearest possible tabular form. Most people have an aversion to figures because, in the mass, they mean little or nothing to them. Interest is not aroused by averages, rates, percentages or comparative statements. The investigation may have convinced the minds of the investigators but it remains to persuade others of the soundness of the conclusions supported by the statistical data. Usually facts do not speak for themselves because people either cannot or will not hear them. Sometimes, the person is too busy and must have his attention fixed upon the important facts by some striking device which avoids time-consuming details. In other cases, the facts themselves are complex and the mind refuses to hold before it several sets of data for comparison at the same time. Sometimes, contact with a person's interest is prevented by the very confusion of a mass of figures. These difficulties must be overcome if results are to follow from the investigation. Facts do not automatically change conditions. They are means to an end. Obviously, methods of presenting them are of the greatest importance.

Therefore, the final step in the presentation of data is the use of the graphic method. The eye aids the mind to grasp the results of the investigation by the use of a diagram, a curve, or a shaded map. In this manner the essentials may be emphasized vividly without confusing details. Comparisons may be shown, on the same chart, of two or more sets of facts. The attention is arrested and thought is stimulated. When skilfully drawn these graphic devices appeal to a far wider group than do the tables from which they have been constructed.

There is a further reason for a careful discussion of graphic statistics. Since, by this method, the statistician conveys the impression through lines and surfaces rather than by tables of figures, the reader is particularly at his mercy. Graphs offer effective means for misrepresenting the facts, either through lack of skill and knowledge of methods of construction, or through deliberate intention. The result of the wrong impression gained from a chart is apt to be the same as if the figures had been misstated or manipulated, and may be more wide-spread. Therefore, the greatest caution is needed in the choice and construction of graphic devices.

In general works on statistics, specific chapters present some of the most important principles of construction and interpretation of graphs,

with a very limited number of illustrations, but Mr. Willard C. Brinton has published recently the first book devoted entirely to the subject. The author has brought together over 250 examples of good and bad graphic devices covering a wide range of subjects in business, social and technical statistics, drawn from both official and private sources. He has classified the material under appropriate chapter-headings and presents with each graph detailed criticisms, in such a manner as to appeal to the non-technical reader—business man, social worker and legislator. Many of the worst practices are condemned from reference to actual examples, and, in many cases, the author has drawn a second chart from the same data to illustrate a better method of presentation. On the whole, the work is well done.

The book must be judged in view of the fact that it is not designed primarily for those having special training in statistical methods. That the author, himself a technical expert—an engineer—has so completely avoided technical terms in the discussion, and yet has, in most cases, successfully presented the material, is one of the noteworthy features of the book. Of course certain chapters present specialized data from business experience, which require familiarity with the facts in order to appreciate the full significance of the graphic devices used, but this knowledge the reader of these portions of the book will possess. The author devotes over 60 pages to charts and records useful to officials of large business concerns. The discussion is not confined strictly to the field of statistics but shows also how graphs may be used by the executive to chart the organization of a business, the routing of materials in the process of manufacture, and the location of rivals in the same field.

A very commendable feature of the book is the arrangement of clear titles and sub-titles for the charts, which are themselves reproduced or drawn with the greatest care, on a very good quality of paper. The titles and legends accompanying the charts are stated in such a manner as to explain the material presented and to express the essential criticism of method for the use of the hasty reader, without reference to the text discussion. This hasty review of charts has its dangers, however, even with the clearest possible titles, and should be discouraged.

In his criticisms of various charts and in the statement of rules for construction the author leaves the impression that the actual figures from which the chart is constructed should always, if possible, appear upon the graph. In the opinion of the reviewer this statement is too emphatic. Graphs are made with vertical and horizontal scales, with rulings to guide the eye, with keys for interpretation, and the impression should be received from the graph and not from the figures. It is desir-

able, therefore, to keep the chart as free as possible from details, especially when the appeal is to persons who care nothing for the exact figures. Besides, the chart is frequently used in connection with the discussion of tables of figures, to which reference may readily be made. It is admitted that where a chart is presented independent of the original data from which it has been drawn, it is very convenient for reference to have the figures included, provided they do not confuse the impression by distracting attention. This may be avoided by placing the tabular statement in inconspicuous type in one corner of the chart.

On page 199 a definition of correlation is given which is apt to prove misleading—"a term used to express the relation which exists between two series or groups of data where there is a causal connection." When correlation has been shown between two sets of data, it does not necessarily indicate a causal connection. (For definition of correlation, see A. L. Bowley's *Elements of Statistics*, p. 316, 2d ed., 1902). A high degree of sympathetic fluctuation of two series of data creates a presumption of some causal connection, but they may fluctuate in sympathy due to an outside cause operating upon each in a similar manner; as, for instance, when bank clearings are large in amount, immigration is also large because both are results of prosperous conditions. This distinction is very important because, while curves are very effective in showing comparisons in the movement of two or more series of data, the greatest caution is needed in the interpretation of the significance of the suggested relations.

The final chapter summarizes more than a score of rules and cautions in the construction of graphic devices which, if observed, would prevent the most serious and frequent errors, as well as increase the effectiveness of this most useful method of presenting facts. To a few of these rules some exceptions may be taken but as a whole they form an extremely useful summary for good statistical practice. At present there are few if any accepted standards of practice in graphic statistics and far too little condemnation of bad devices. Editors who would be humiliated if bad English or actual misstatement of facts should be discovered in their columns, go on publishing bad graphs which just as surely convey a wrong impression. Recently, the American Society of Mechanical Engineers invited about fifteen of the leading American scientific societies of national scope to appoint representatives on a Joint Committee On Standards of Graphic Presentation. No report has been issued. The author has presented his discussion at a time when it will prove most useful in promoting better standards of practice in graphic statistics.

ROBERT E. CHADDOCK.